

CLAIMS

1. A method of monitoring the setting operation for a blind fastener, comprising the step of:

measuring, as a function of time, an electronic signal indicative of the load being applied to the fastener during the setting operation;

determining a mandrel entry load and an associated mandrel entry time from said signal;

determining a setting load and an associated setting time from said signal; and

determining the time difference between said mandrel entry time and said setting time and comparing said time difference against a predetermined reference time difference associated with said fastener to determine whether the set fastener complies with a predetermined acceptable setting procedure.

2. The method as claimed in claim 1, wherein the difference between the setting load and the mandrel entry load is determined and compared against a predetermined reference load difference value to determine whether said set fastener complies with a predetermined acceptable setting procedure.

3. The method as claimed in claim 1, wherein an output signal is generated in the event that said fastener set is determined not to comply with said predetermined acceptable fastener setting procedure.

4. The method as claimed in claim 1, comprising the step of analysing the difference between the determined time difference and the reference time difference when said fastener set is determined not to comply with said predetermined fastener setting procedure to identify the reason for non-compliance.

5. The method as claimed in claim 1, wherein the predetermined reference time difference is determined as the time difference between mandrel entry time and mandrel setting time of a blind fastener set in a known workpiece, and said step of comparing the measured time difference against said predetermined reference time difference comprising identifying whether or not said measured time difference is greater than said reference time difference by a predetermined value indicative of a free set operation and generating a reject signal in the event that such free set operation is detected.

6. The method as claimed in claim 5, further comprising determining a minimum load value after said mandrel entry load is determined and an associated minimum load time and comparing at least one of said minimum load value or minimum load time against a predetermined minimum load value or predetermined minimum load time to identify the reason for non-compliance.

7. The method as claimed in claim 1, further comprising the step of visually displaying a graphic plot of monitored load applied to the rivet against time.

8. A method of monitoring a series of setting operations for at least two different blind fasteners, comprising the step of :

predetermining the sequence of blind fasteners to be set in said series and monitoring the setting operation of each of said fasteners in said series according to the method of claim 1, wherein the predetermined reference time associated with each of the at least two different blind fasteners is preset against each of the setting operations for that particular fastener in said series.

9. A method of monitoring a series of setting operations for at least two different blind fasteners, comprising the step of:

predetermining the sequence of blind fasteners to be set in said series and monitoring the setting operation of each of said fasteners in said series according to the method of claim 2, wherein the predetermined reference load value associated with each of the at least two different blind fasteners is preset against each of the setting operations for that fastener in said series.

10. The method as claimed in claim 1, wherein said predetermined reference time is determined by undertaking a plurality of setting operations for said selected fastener type, measuring a signal indicative of the load being applied to the fastener during the setting operation, as a function of time;

determining a mandrel entry load and an associated mandrel entry time from said signal for each of said plurality of operations;

determining a setting load and an associated setting time from said signal for each of said plurality of operations;

averaging said determined values of mandrel entry load, mandrel entry time, setting load and maximum setting time for said plurality of operations, and calculating said time difference between said averaged mandrel entry time and said averaged setting time to provide said predetermined reference time difference.

11. The method as claimed in claim 1, wherein said predetermined reference time is determined by undertaking a plurality of setting operations for said selected fastener type, measuring a signal, which is indicative of the load being applied to the fastener during the setting operation, as a function of time;

determining a mandrel entry load and an associated mandrel entry time from said signal for each of said plurality of operations;

determining a setting load and an associated setting time from said signal for each of said plurality of operations;

determining the time difference between said mandrel entry time and said setting time;

averaging the determined values of said time differences for said plurality of operations to provide said predetermined reference time difference.

12. The method as claimed in claim 8, wherein said multiple setting operations are undertaken by a plurality of different setting tools wherein an electronic signal indicative of applied load is generated by each setting tool during a setting operation and each electronic signal is analysed sequentially according to the predetermined order of setting of said blind fasteners.

13. The method as claimed in claim 1, further comprising comparing said measured mandrel entry time against a predetermined mandrel entry time to determine wear of a set of jaws of a fastener setting tool.

14. A blind rivet setting system comprising:
- a fastener setting tool;
 - a signal generating device for producing a signal indicative of the load being applied to a blind fastener during a setting operation;
 - a controller connected to said tool and to said signal generating device for measuring said signal as a function of time and determining therefrom (i) a mandrel entry load and an associated mandrel entry time, (ii) a setting load and an associated setting time, and (iii) the time difference between said mandrel entry time and said setting time, and comparing said time difference against a predetermined reference time difference associated with said fastener to determine whether the set fastener complies with a predetermined acceptable setting procedure.
15. A system as claimed in claim 14, further comprising a plurality of setting tools for setting at least two different blind fasteners, each tool having an associated signal generating device, and further wherein said controller is connected to each of said tools and said associated signal generating devices for analyzing each signal produced by said signal generating devices sequentially according to the order of setting of said blind fasteners.
16. A system as claimed in claim 14, further comprising an automated fastener feed system for supplying blind fastener to said setting tool.
17. A system as claimed in claim 16, wherein said automated fastener feed system is capable of delivering at least two different blind fasteners.
18. A system as claimed in claim 14, wherein said fastener setting tool comprises a fluid actuated piston for applying load to said fastener and said signal generating device comprises a pressure transducer.

19. A system as claimed in claim 14, wherein said controller includes a visual display for plotting the signal output versus time.
20. A system as claimed in claim 14, further comprising an indicator means which is actuated when said fastener set is determined not to comply with said predetermined acceptable fastener setting procedure.